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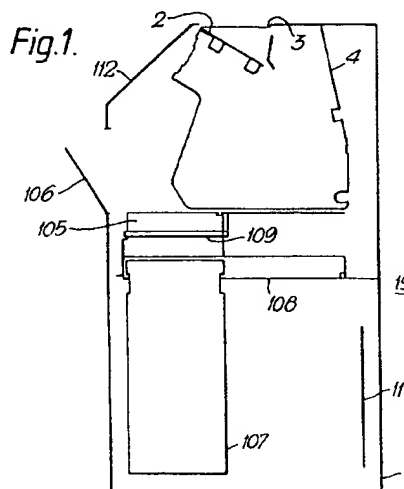
(71) Applicant: **DE LA RUE INTER-INNOVATION  
AB  
Nybohovsbacken 23-25,  
Box 47324  
S-100 74 Stockholm (SE)**

(72) Inventor: **Martin, Harvey Graham  
Cedar Lodge,  
Oakfield Avenue,  
East Wittering  
Chichester, West Sussex, PO20 8BU (GB)**

(74) Representative: **Skone James, Robert  
Edmund  
GILL JENNINGS & EVERY  
Broadgate House  
7 Eldon Street  
London EC2M 7LH (GB)**

(54) Document deposit apparatus.

(57) Document deposit apparatus comprises a document inlet (2) into which documents to be deposited are inserted. Processing means (15,18) monitor one or more characteristics of the documents. Rollers (15,18,19) transport documents from the document inlet (2) through the processing means. A temporary store (105) is provided to which the documents from the processing means are fed by the rollers, the temporary store being accessible to a user from outside the apparatus through an access door (106). A controller (110) indicates to the user the contents of the temporary store and, when the user agrees with the contents, passes the documents in the temporary store to a deposit region.



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The invention relates to document deposit apparatus, for example for banknotes, cheques or other security documents.

The use of Cash Dispensers to assist Bank Tellers is well known. They provide Banks with advantages in Productivity, Accounting accuracy and Security. Further, when connected "Online" they permit easy interchange of staff at lunch and other "break" times with minimal cash balancing activities and consequent cost and delays. However, since most Tellers take in deposits of cash and cheques in addition to dispensing, there is currently unavoidable need to count/balance such deposits at change over times to protect both Bank and Tellers.

The object of this invention is to provide an automated Deposit facility which may be connected online to a Bank's host computer and thereby eliminate the need for regular/intermediate manual cash balancing. Complex devices are available, from Japan and other sources, which provide this service. However, they are generally both too large and too costly for many Banks to justify commercially.

For example, US-A-4889220 describes a document deposit apparatus in which documents are fed through a discriminator which determines whether or not the documents are valid. Valid documents are then fed to a valid document temporary store and invalid documents to an invalid document temporary store. The user is then allowed access to the invalid document temporary store so that he can withdraw the documents and re-feed them. A similar approach is described in GB 2073718 in which documents are discriminated and then fed to either a valid or invalid temporary store. As explained above, however, these systems are complex and bulky and not well suited to the rugged environment of banks and the like where they are used.

In accordance with the present invention, document deposit apparatus comprises a document inlet into which documents to be deposited are inserted; processing means for monitoring at least for the presence of a document; transport means for transporting documents from the document inlet through the processing means; a temporary store to which the documents from the processing means are fed by the transport means, the temporary store being accessible to a user from outside the apparatus through an access door; and control means for indicating to the user the contents of the temporary store and, when the user agrees with the contents, for passing the documents in the temporary store to a deposit region and is characterised in that the transport means feeds all documents passing through the processing means to the same temporary store.

The invention provides a very simple document deposit apparatus which is easy to use by, for example, a bank Teller but which provides a bank customer with considerable confidence that the documents he

is depositing have been correctly recorded. In particular, simplicity in performance and construction is achieved by providing the temporary store at a position at which it is accessible by the user from outside the apparatus and by transporting all documents to the same temporary store.

The access door may be permanently locked, for example by a key, and only be unlocked if the user does not agree that the contents of the temporary store are correct. Preferably, however, the access door is normally closed, the apparatus further comprising a door lock which is normally unlocked but which is locked by the control means at least after the user has agreed the contents of the temporary store.

This provides a very simple way of enabling easy access to the temporary store if it is necessary to remove the documents but as soon as the contents of the temporary store are agreed, then the door is locked while the contents of the temporary store are passed to the deposit region.

In the preferred arrangement, the access door is at least partially transparent to enable the contents of the temporary store to be viewed. This provides an even higher degree of confidence to the user.

Typically, the control means is responsive to the position of the access door to cancel the transaction and prevent documents being fed into the deposit region as soon as the door is opened.

In some cases, the documents in the temporary store could be conveyed by conveying means such as belts and the like to a remote deposit region. However, preferably the deposit region is positioned adjacent to the temporary store in order to reduce as far as possible the size of the apparatus.

In the preferred arrangement, the deposit region is positioned beneath the temporary store. In this case, the documents in the temporary store could be pushed into the deposit region but preferably the floor of the temporary store is moveable to allow the documents to drop under gravity into the deposit region.

The deposit region itself may be defined by a bag or other insecure container or a cassette or the like.

In a modification, more than one deposit region could be provided. For example, a second deposit region may be provided adjacent the first deposit region, the apparatus further comprising means for passing documents in the temporary store to the second deposit region. Typically, this means could comprise a slidable frame which slides over the floor of the temporary store to draw the documents to a position above the second deposit region.

The processing means may comprise any document detector, for example as described in EP-A-0168202. The processing means preferably determines one or more characteristics of the documents, such as the length of the document in the feed direction which is often characteristic of the denomination of the document. Thus, in operation, the apparatus

will normally store data defining the dimensions of the different documents which it is expected to handle so that it can perform an identification process on the documents which are fed. In addition or alternatively to determining the dimensions of the documents, the processing means may include an ultraviolet sensor and/or a magnetic sensor for carrying out conventional ultraviolet or magnetic analysis of the documents. Thus, in the case of banknotes, it is common to find certain ultraviolet responsive or magnetic responsive security features which can be used to assist validation of the documents.

Preferably, a detector is positioned in the temporary store to indicate the presence of documents in the temporary store. This detector can be used by the control means to ensure that all documents in the temporary store have passed to the deposit region or have been removed before the feeding of further documents in a subsequent operation is permitted.

In some cases, the operator is able to process and enter manually the value of documents which are not recognised by the apparatus detectors or fall outside the parameters set for the documents that are expected by the apparatus.

The apparatus could be used as a stand alone module or as an accessory product to a Teller cash dispenser or the like. When used with a dispenser, it could be arranged that banknotes accepted by the apparatus are fed to a deposit region which can be accessed by a cash dispenser. In this way, the banknotes can be recycled.

Some examples of document deposit apparatus according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic side view of a first example of the apparatus;

Figure 2 is a side view of the apparatus shown in Figure 1 illustrating the components in more detail;

Figure 3 is a partial cross-section through part of the sheet sensing apparatus with parts omitted for clarity;

Figure 4 is a section taken on the line A-A in Figure 3;

Figure 5 is a block diagram of the circuit for operating the sheet sensing apparatus shown in Figure 2;

Figure 6 is a front elevation of the apparatus with parts of the sheet sensing apparatus omitted for clarity;

Figures 7A-7D illustrate the use of a controlled drop cassette;

Figure 8 is a block diagram of the control system; and,

Figures 9 and 10 are views similar to Figure 2 but with parts omitted for clarity showing a second example of the apparatus.

The apparatus shown in Figures 1-6 is mounted

within a steel enclosure 1 and includes a document feed hopper 2 mounted beneath an inlet opening 3 in the enclosure 1. In this case, the deposit module is mounted to the front of a conventional cash dispenser 19 (not shown). The hopper 2 forms part of a sheet processing apparatus 4 similar to the De La Rue 2520 sheet counter which is described in more detail in EP-A-0168202.

As shown in Figure 2, the counter 4 comprises a metal housing 1' part of which defines the input hopper 2. Two conventional picker wheels 5 are rotatably mounted to the housing 1' and have radially outwardly projecting bosses 6 which, as the picker wheels rotate, periodically protrude through slots in the front of the hopper 2.

A pair of drive rolls 15 are non-rotatably mounted to a drive shaft 16 which is rotatably mounted to the housing 1. Each drive roll 15 has an outer annular portion 17 of rubber. Each drive roll 15 contacts a respective auxiliary roll 18 rotatably mounted on a shaft 14.

A pair of stripper rollers 19 are rotatably mounted on a shaft 20 having a larger diameter than the shaft 16 about which it is positioned. The shaft 20 is secured between a pair of arms 21 of a cradle 22. The cradle 22 is rotatably mounted to an auxiliary drive shaft 23 on which the picker wheels 5 are mounted. The cradle 22 has a cam portion 24 which engages a cam 25 rotatably mounted on the housing 1'. Manual rotation of the cam 25 forces the stripper rollers 19 towards the separation rollers 10 to define gaps of controlled width.

Removable guiding 7 having a curved guide surface 8 extends partly around the circumference of the rollers 15, 19 allowing the operator access to the note feed path so that a note jam can be cleared. Two separation rollers 10 (only one shown in the drawings) are rotatably mounted to a shaft 11 supported between lugs 9.

A drive motor 30 (shown schematically in Figure 2) continuously drives the drive shaft 16 via a drive belt 31. The connection between the drive belt 31 and the drive shaft 16 has been omitted for clarity. The auxiliary drive shaft 23 is driven via a drive belt 32 by a drive motor 33 and is connected by a drive belt (not shown) to the stripper roller 19.

A guide plate 34 extends from adjacent the nips formed between the drive rolls 15 and auxiliary rolls 18 to a conventional stacker wheel 35 rotatably mounted on the housing 1'.

The drive rolls 15 and auxiliary rolls 18 define sheet sensing apparatus for detecting the passage of two or more notes simultaneously and for counting banknotes. The drive rollers and auxiliary rolls are spaced apart by a distance less than the width of sheets being counted.

The shaft 14 is hollow, and is non-rotatably supported by the housing 1', and carries the two auxiliary rolls or roller assemblies 18. These are identical in

construction and each contacts a respective one of the drive rolls 15.

Each roller assembly 18 comprises a roller bearing having an annular outer race 38 (Figures 3 and 4), an annular inner race 39 and bearings 40 positioned between the inner and outer races. The bearing is mounted coaxially about the shaft 14 on an annular rubber portion 41. A metal pin 42 abuts the radially inner surface of the inner race 39 and extends through the rubber portion 41 and an aperture 43 in the shaft 14 into the shaft.

A moulded plastics housing 44 is mounted within the shaft 14 and comprises a central tubular portion 45 integral with end portions 46 each of which has a bore 47 communicating with the tubular portion 45. A pair of light emitting diodes 48 are mounted in the inner ends of the bores 47 while a pair of phototransistors 49 are mounted at the outer ends of the bores 47. For clarity, only portions of the connecting wires from the light emitting diodes 48 and the phototransistors 49 have been illustrated. In fact, these wires will pass along and out of the shaft 14 to monitoring circuitry to be described below and to facilitate assembly, all wires extend from the same end of the shaft. Each portion 46 of the housing 44 also has an aperture 50 communicating with the bore 47 and in alignment with the aperture 32. The pins 42 extend through the apertures 50 into the bores 47.

The circuitry is illustrated in more detail in Figure 5. Figure 5 illustrates the two light emitting diodes 48 and the phototransistors 49 each of which is connected to a power source 51. The section of the circuit shown enclosed in dashed lines is that section mounted in the plastics housing 44. The output from each phototransistor 49 is fed via respective amplifiers and A/D converters 52 to a microcomputer 53 which constitutes the main controller for the counter.

Initially, the drive rolls 15 are rotated and with no sheet present between the drive rolls 15 and roller assemblies 18, any deflection of each roller assembly 18 accompanied by compression of respective resilient portions 41 adjacent the drive rolls 15 will be sensed typically at forty equally spaced intervals through one revolution of the roller assemblies 18. Compression of each rubber portion 41 in a radially inward direction will be accompanied by radially inward movement of each pin 42. Each LED 48 continuously emits light which impinges on respective phototransistors 49 causing them normally to be partially switched on. If a pin 42 moves radially inwardly, the pin 42 will increasingly obscure the path of optical rays from the LED's to the phototransistors 49 thus increasing the amount by which the phototransistors 49 are cut off. The output from the phototransistors 49 is fed via the amplifiers and A to D converters 52 to the microprocessor 53. The microcomputer 53 generates an error signal which is fed back to the amplifiers 52 via D to A converters 55 to bring the signal back to

a reference value. This is done at forty equally spaced sampling positions around the drive rolls 15 (which will be determined by monitoring a timing disc (not shown) mounted non-rotatably to the shaft 16). This produces forty sampled voltage values which are then stored in respective memories 54 as a guide surface profile or datum level. A similar system is explained in more detail in EP-A-0168202.

In use, a stack of banknotes is placed in the input hopper 4. The drive motors 30,33 are actuated so that both the drive shaft 16 and the auxiliary drive shaft 23 rotate. Rotation of the picker wheels 5 causes banknotes at the bottom of the stack to be urged towards a nip 38 between the stripper rollers 19 and the separation rollers 10. As the stripper rollers 19 rotate in response to the rotation of the auxiliary drive shaft 23, they will engage the adjacent note and carry this note past the guide surface 8 and into the nip 58 formed between the auxiliary rolls 18 and drive rolls 15. The width of the gaps between the stripper rollers 19 and separation rollers 10 will prevent more than one note being fed by the stripper rollers 19. The note will be fed between the drive rolls 15 and the auxiliary rolls 18 due to the continuous rotation of the shaft 16, the note being fed along the guide plate 34 into the stacker wheel 35 which is being rotated by the drive motor 30 and which will stack the note fed in the output hopper 37.

As the note passes between the drive rolls 15 and the auxiliary rolls 18, the corresponding rubber portions 41 will be compressed with accompanying radially inward movement of each pin 42. This will cause a variation in the light received by the phototransistors 49 which is monitored at the same forty sampling positions. The monitored values are then compared with the previously stored datum and the difference compared with a threshold to indicate whether or not the thickness of the note is greater than the threshold thus indicating whether or not the note is valid.

Other types of monitoring system could be provided including for example an optical system.

The counter 4 thus counts the notes and also monitors the length in the feed direction of the notes, the notes then being stacked by the pair of conventional stacker wheels 35 on a stacker tray 105 forming an escrow store. The tray 105 is accessible by the bank Teller via a secure, escrow door 106 which is transparent to enable the contents on the tray 105 to be viewed.

The stacker tray 105 is positioned above a tamper indicating cassette 107 mounted on a supporting chassis 108. The tray 105 is slidable to the right, as seen in Figure 1 from underneath a stack of notes which are then allowed to fall into the cassette 107.

Movement of the tray 105 is controlled by a motor 117 coupled via pulleys 122 to a lead screw 123 journaled in bearings 124 beneath the sheet processing apparatus 134. The lead screw 123 is coupled via

nuts 125 to the tray 105 so that when the lead screw is rotated by the motor 117, the tray 105 is drawn to the right, as seen in Figure 2. A set of depending fingers 126 extend downwardly to a position adjacent the top of the tray 105 so that as the tray is drawn beneath the fingers, any sheets stacked on the tray will be pushed off and allowed to drop into the cassette 107. Sensors (not shown) are provided to ensure the cassette is properly inserted and not full.

In the example just described, the sheets simply fall into the cassette 107. In an alternative example (Figure 7) a "controlled drop cassette" 107 may be used which contains a movable floor 130 on which sheets are stacked. In this example, a stack of sheets 131 is loaded onto the tray 105 which remains in position until the floor 130 has been moved upwardly (by a means not shown) until an existing stack 132 on the floor 130 is sensed by a sensor 133 to be substantially in alignment with the top of the cassette 107. (This is shown in Figure 7A). The tray 105 is then drawn away (Figure 7B) allowing the stack 131 to drop by a very short distance onto the top of preexisting stack 132 on the floor 130. The floor 130 is then lowered to its rest position detected by a sensor 134 (Figures 7C and 7D) and the tray 105 is returned to its stacking position.

Operation of the apparatus is controlled by a microprocessor 110 (Figure 8) mounted on a PCB 111 (Figure 1).

The microprocessor 110 is connected to a keypad 112 positioned on an outwardly facing surface of the enclosure 1 to enable the operator to input information to the microprocessor 110. A display is also associated with the keypad 112 to display information as described below.

The microprocessor 110 is also coupled to the sheet detector within the apparatus 4, and to the drive motors 30, 33 of the apparatus 4. Control of the counter (apparatus 4) is a function of the counter microprocessor 53 which operates upon receiving commands from the microprocessor 110 and reports back data such as the number of documents of each specific type and/or dimensions based upon parameters specified by the microprocessor 110.

A door position detector 115 (not shown in Figure 1) is provided to detect whether or not the door 106 is in its closed position, the detector being coupled with the microprocessor 110. The microprocessor 110 can also control a lock (not shown) for the door 106 via a control unit 116.

The position of the floor 109 of the escrow store 105 is controlled by the microprocessor 110 via a floor drive unit 117 while a sheet detector 118 (only shown in Figure 8) is positioned within the escrow store 105 to detect the presence of sheets in the store.

In operation, a customer will hand the bank teller a number of bank notes he wishes to deposit. These banknotes will be of a type which the apparatus ex-

pects, for example a selection of sterling banknotes. Once the stack has been loaded in the hopper 2 through the inlet 3, the bank Teller presses a start button on the keypad 112 which causes the microprocessor 110 to commence the feed operation of the apparatus 4. This involves commanding the microcomputer 53 to activate the transport motor 30 and the stripper motor 33 so that single sheets are fed from the hopper 2 through the detection system and are then stacked in the escrow store 105. The detection system, as explained above, counts the notes and checks their singularity and the microprocessor 53 attempts to identify the notes by denomination using conventional methods such as long edge size, short edge size, ultraviolet or magnetic properties. If a document cannot be identified then the operator is prompted to enter the value. The operator may view the note through the clear section of the door 106.

Once all the notes have been fed into the escrow store 105, the microprocessor 110 displays on the display 112 the total value of the notes which it believes are within the store 105. The notes can be seen through the (transparent e.g. clear plastics) door 106. At this time, the Bank Teller presses a "hold" button on the keypad which prevents any further sheets being fed from the hopper 2 but, at this stage, does not permit the floor 109 to be moved.

If the customer does not agree with the displayed total then the Bank Teller opens the door 106 and manually removes the stack of notes. The door 106 is then closed. As soon as the door position detector 115 detects that the door 106 has been opened, this information is passed to the microprocessor 110 which cancels the transaction and will not permit the floor 109 to be moved.

Once the customer has agreed that the correct total value for the notes he wishes to deposit is indicated, the Bank Teller presses the "hold" key on the keypad 112 again causing the microprocessor 110 to activate the door lock control 116 to lock the door 106 in its closed position preventing further access to the escrow store 105 from outside the apparatus and thereafter to activate the floor drive 117 to move the floor 109 to the right, as seen in Figure 1. The sheets then pass into the cassette 107. In one example, as soon as the escrow detector 118 cannot detect that there are any sheets left in the escrow store 105, the floor 109 is driven back to its initial position and the operation is completed. In the preferred example, the escrow floor 109 is drawn fully to the right before it is moved back to its initial position. It is "assumed" this action results in all the notes entering the cassette 107. When the floor has returned to its initial position, the escrow detector 118 is used to determine that no notes have been left on the escrow floor 109. Optical sensors (not shown) are used to monitor and control the position of the escrow floor 109. If detector 118 senses that notes have remained on the escrow floor

109, the customer access door 106 remains locked until a supervised recovery routine has been completed. At this point, the escrow door 106 is unlocked and the feeding of further notes from the hopper 2 is permitted.

It will be understood that the banknotes placed in the hopper 2 could be all of the same denomination or of different denominations providing all denominations are expected by the apparatus.

In the case of cheques or badly damaged notes which cannot be automatically read, then the teller will need to enter the fact that these are being processed via the keypad 112. Cheque values can be entered via a host computer 120 to which the microprocessor 110 is connected. Cheque values could also be entered via an enhanced version of the keypad 112. The host computer also receives data for accounting purposes from the microprocessor 110.

A second example of a deposit system is shown in Figures 9 and 10. In this case, two cassettes 107, 136 are provided beneath the sheet processing apparatus 4. The construction of the apparatus for the purposes of loading sheets into the cassette 107 is the same as in the Figure 1 example and will not be described in further detail. In order to move stacked sheets into the cassette 136, an additional frame 137 is slidably mounted to the apparatus for movement between a position overlying the cassette 107 (see Figure 9) and a position overlying the cassette 136 (Figure 10). The frame 137 has no base so that when positioned above the cassette 107, movement of the tray 105 will allow sheets to drop into the cassette 107 as before. The frame 137 is driven by a separate lead screw 138, positioned laterally offset from the lead screw 123, and motor (not shown) in a similar way to the tray 105 and as it is drawn to the right, as seen in Figure 9, it will carry with it any sheets stacked on the tray 105 so that they overlie the cassette 136 into which they will drop since there is no floor at that position.

#### Claims

1. Document deposit apparatus comprising a document inlet (2) into which documents to be deposited are inserted; processing means (15,18) for monitoring at least for the presence of a document; transport means (15,18,19) for transporting documents from the document inlet (2) through the processing means; a temporary store (105) to which the documents from the processing means are fed by the transport means, the temporary store being accessible to a user from outside the apparatus through an access door (106); and control means (110) for indicating to the user the contents of the temporary store and, when the user agrees with the contents, for pass-

ing the documents in the temporary store to a deposit region, characterised in that the transport means (15,18,19) feeds all documents passing through the processing means to the same temporary store (105).

2. Apparatus according to claim 1, wherein the access door (106) is normally closed, the apparatus further comprising a lock operable by the control means (110) to lock the door in its closed position at least after a user has agreed the contents of the temporary store.

3. Apparatus according to claim 1 or claim 2, wherein at least part of the access door (106) is transparent to enable the contents of the temporary store (105) to be viewed.

4. Apparatus according to any of the preceding claims, wherein the temporary store (105) is positioned above the deposit region.

5. Apparatus according to claim 4, wherein the floor (109) of the temporary store (105) is movable from underneath documents in the temporary store to allow the documents to drop under gravity into the deposit region.

6. Apparatus according to any of the preceding claims, further comprising a second deposit region (136), the control means being operable to move documents in the temporary store to either the first or the second deposit region.

7. Apparatus according to claim 6, further comprising a slidably frame (137) for sliding documents in the temporary store (105) across its floor (109) to the second deposit region (136).

8. Apparatus according to any of the preceding claims, further comprising a document detector for detecting the presence of documents in the temporary store (107).

9. A method of operating document deposit apparatus according to any of the preceding claims, the method comprising supplying at least one document to the document inlet, the or each document then being transported to the temporary store, the step of agreeing the contents of the temporary store including the step of the operator supplying to the control means a value constituting an operator determined value for the document(s).

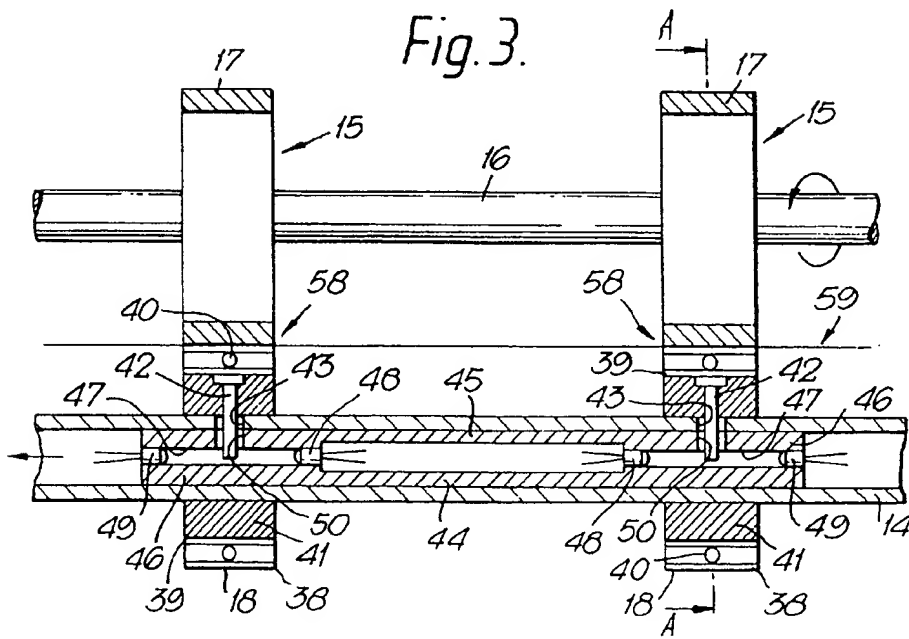
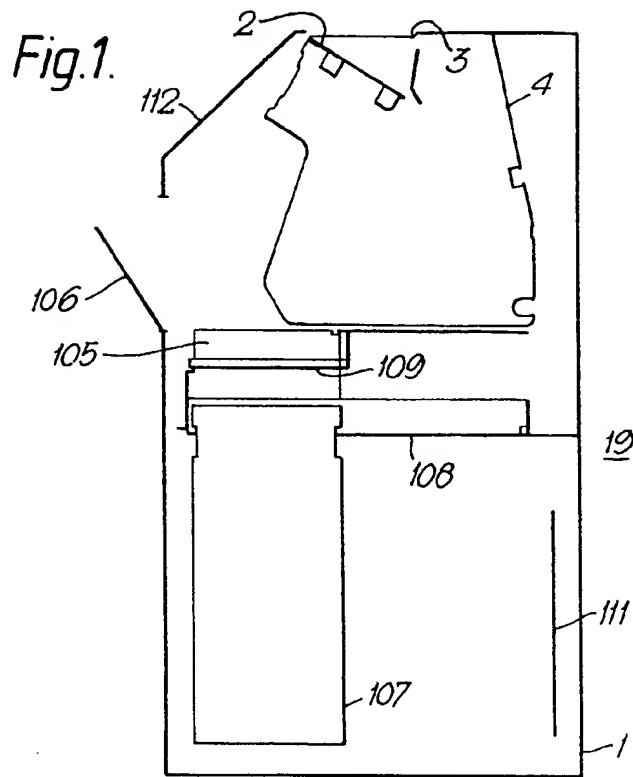


Fig. 2.

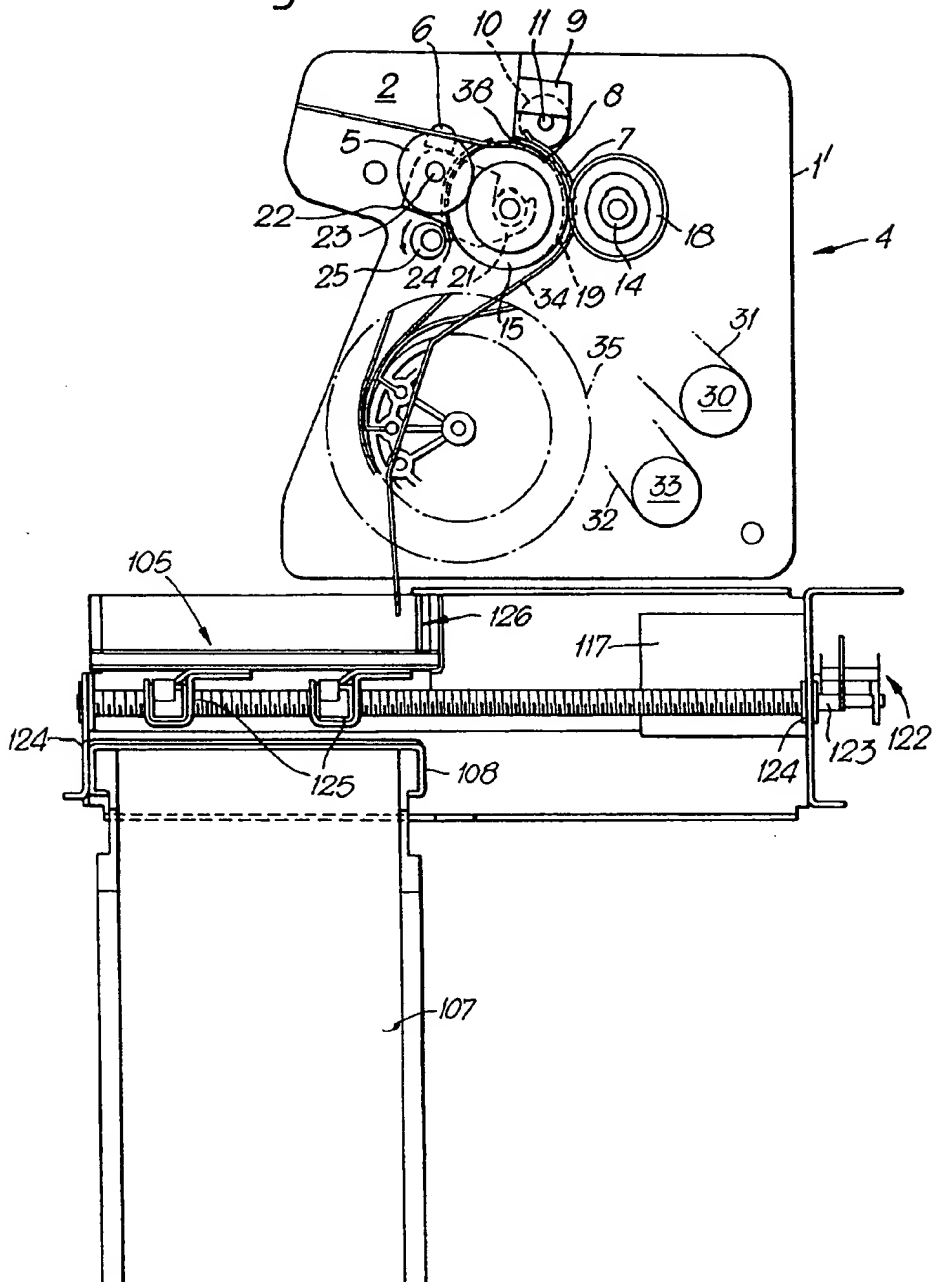




Fig.4.

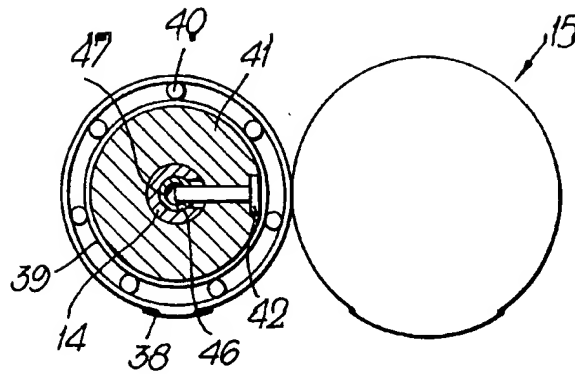


Fig.5.

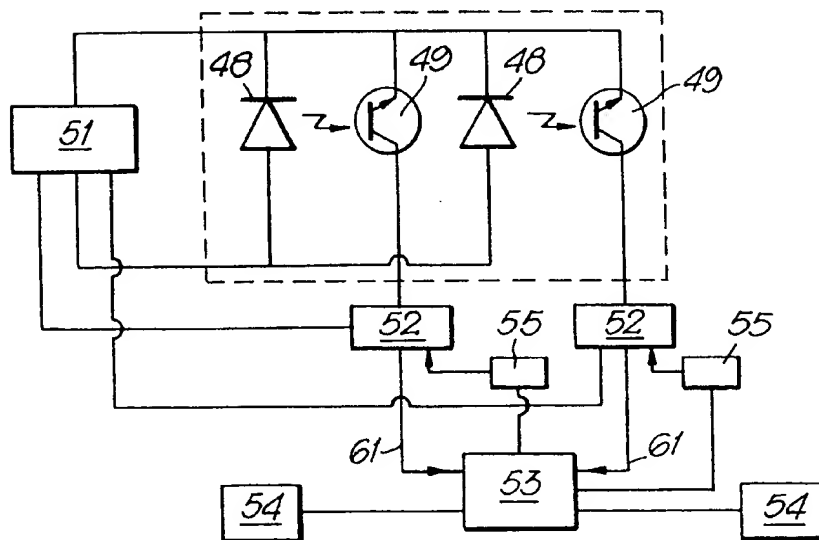


Fig. 6.

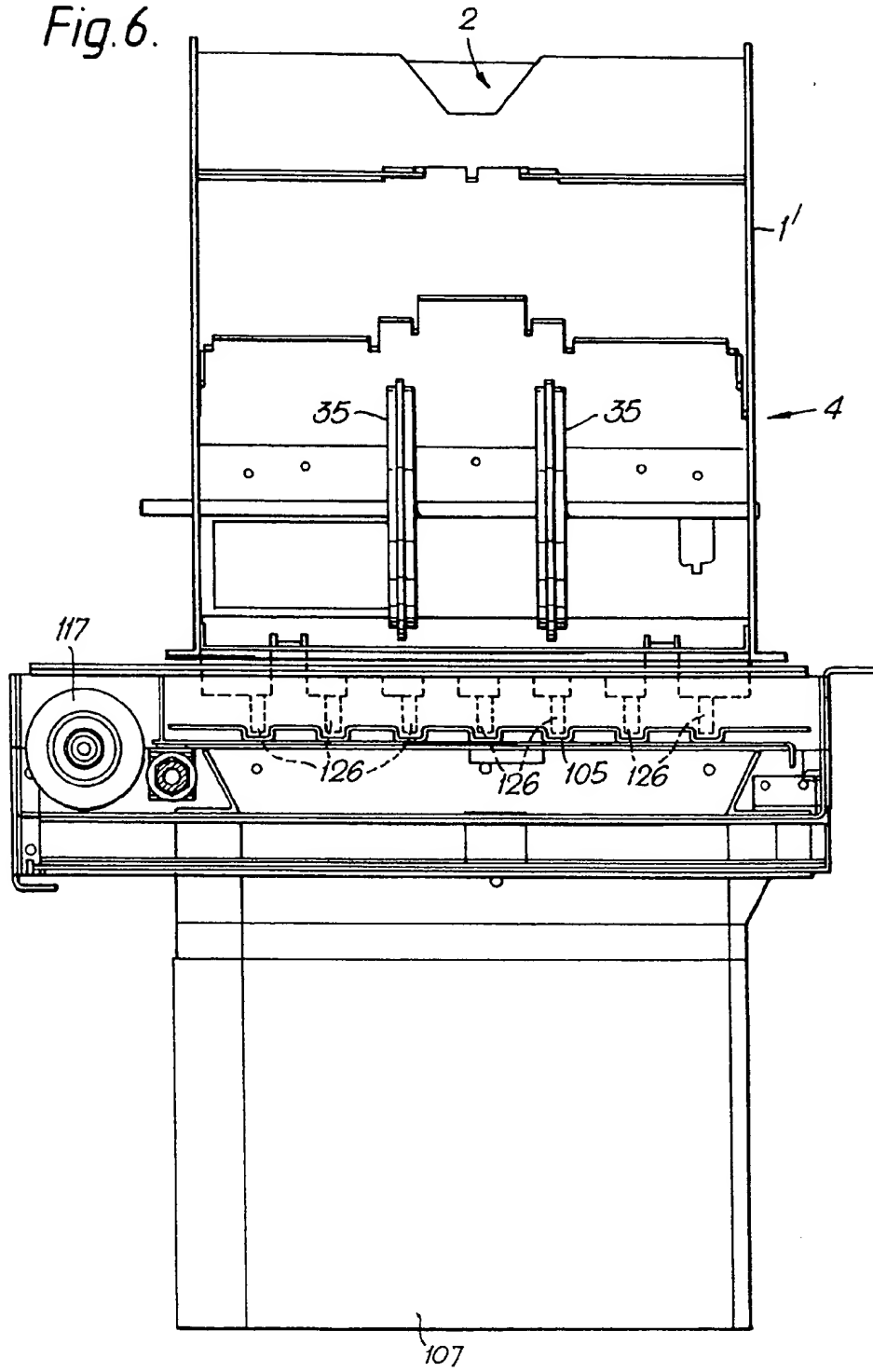


Fig.7A.

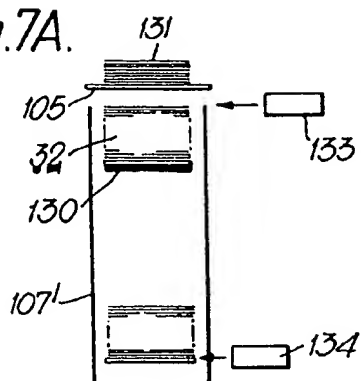


Fig.7B.

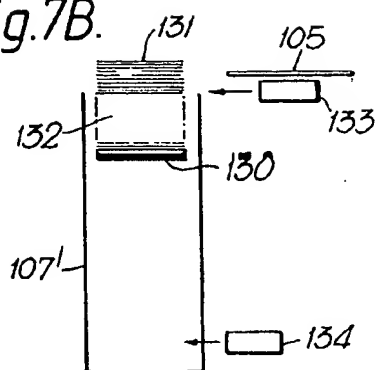


Fig.7C.

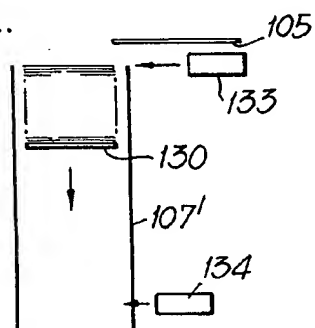


Fig.7D.

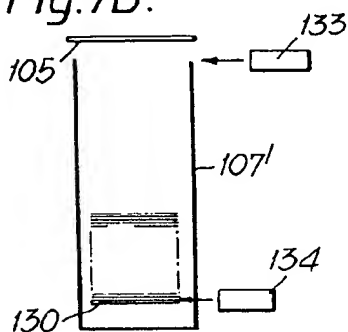


Fig. 8.

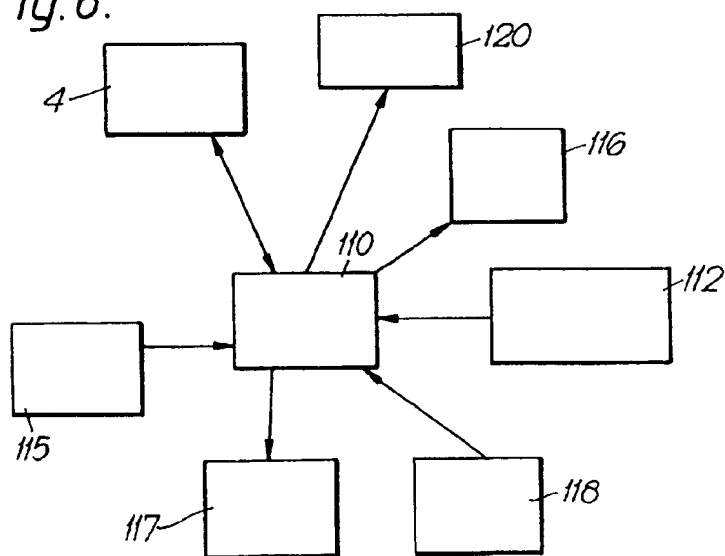


Fig. 9.

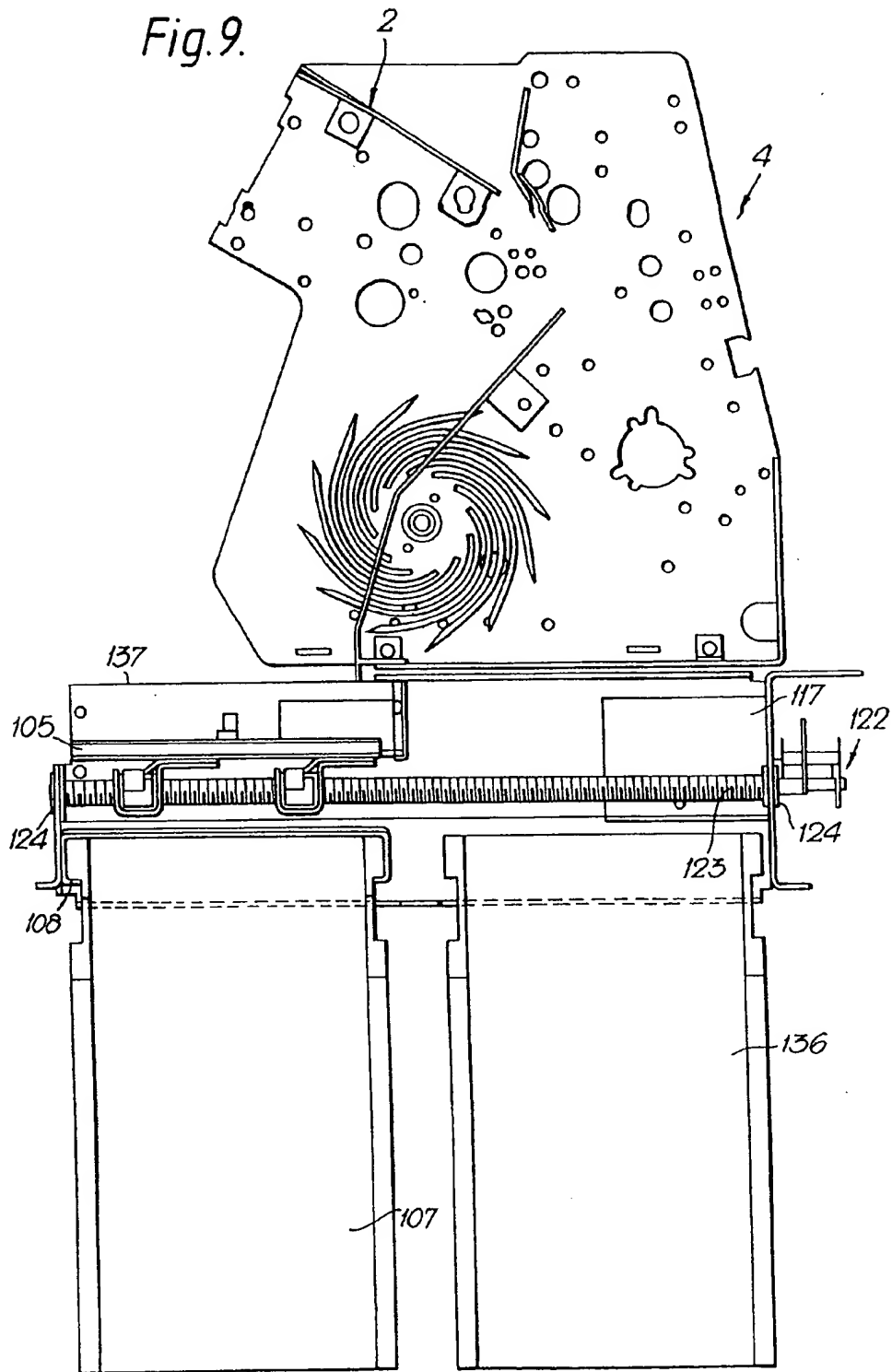
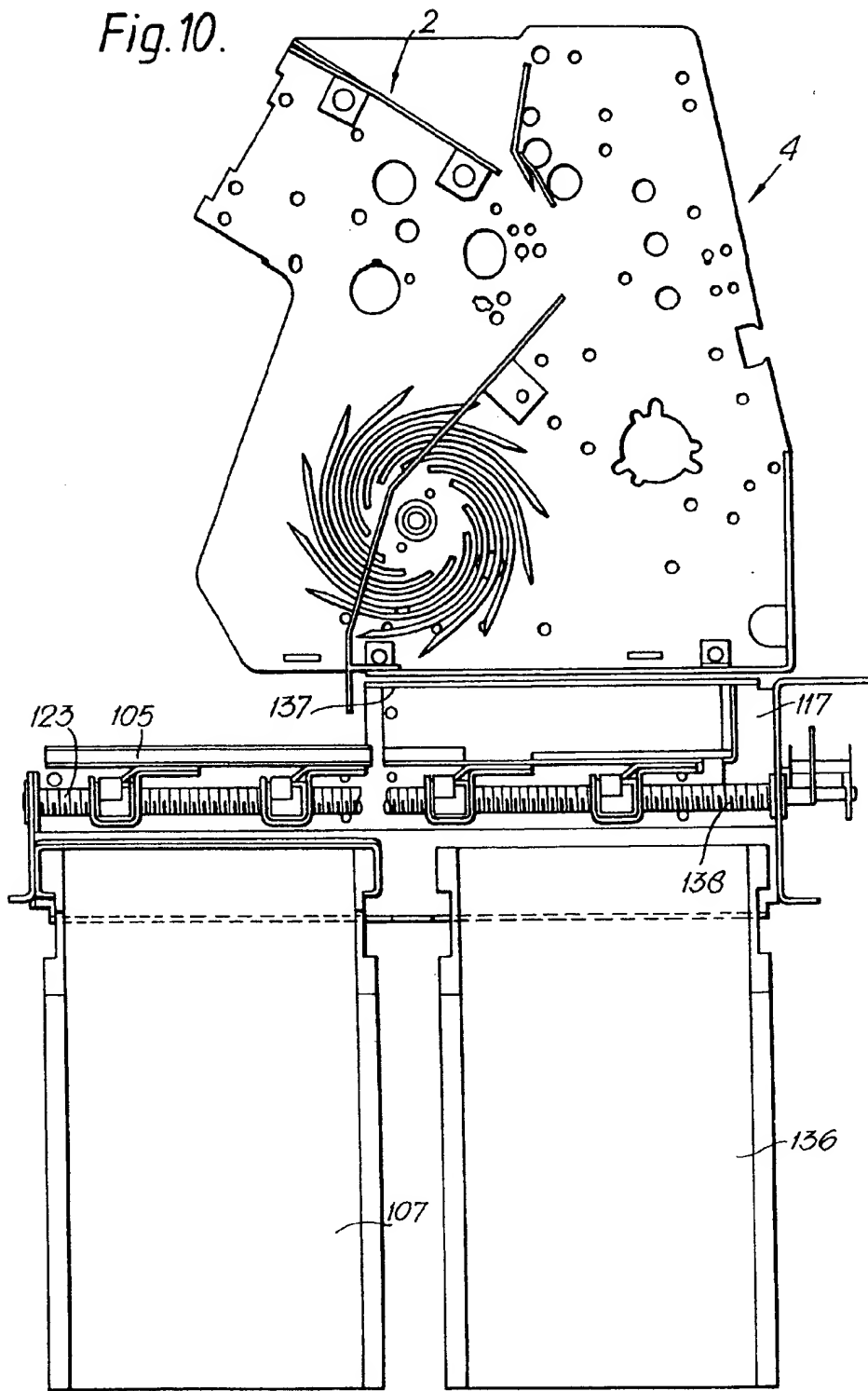


Fig.10.





European Patent  
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## EUROPEAN SEARCH REPORT

Application Number  
EP 94 30 1211

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D, Y	GB-A-2 073 718 (LAUREL BANK MACHINE) * abstract; figures * * page 1, line 90 - page 2, line 65 *	1, 4, 5, 9	G07F19/00
A	---	6-8	
Y	CH-A-590 525 (INPAT) * the whole document *	1, 4, 5, 9	
A	---	2	
Y	& DATABASE WPI Week 7736, Derwent Publications Ltd., London, GB; AN 77-H3507Y & CH-A-590 525 (INPAT ESTABLISHMENT) 15 August 1977 * abstract *	1, 4, 5, 9	
A	---	2	
D, A	US-A-4 889 220 (K. YOSHINORI) * abstract; claims; figures 1-7B * * column 4, line 5 - column 5, line 29 *	1, 2, 4, 5, 8, 9	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	US-A-3 064 785 (R.I.N. WEINGART) * the whole document *	1, 3-5, 8, 9	G07F G07D
A	DE-A-26 00 963 (LAUREL BANK MACHINE) ---		
A	US-A-3 765 523 (T. NAKANISHI) -----		
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		6 June 1994	David, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons * : member of the same patent family, corresponding document			

EPO FORM 1501 (12/92) (P04/01)